

# ROAD SAFETY AUDIT

Route 28 at Santuit-Newtown Road

Town of Barnstable

December 9, 2021

Prepared For:  
MassDOT



Prepared By:  
Cape Cod Commission



CAPE COD  
COMMISSION

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## Background

The Federal Highway Administration (FHWA) defines a Road Safety Audit (RSA) as the formal safety examination of an existing or future road or intersection by an independent, multidisciplinary team. The purpose of a Road Safety Audit is to identify potential safety issues and possible opportunities for safety improvements while considering all roadway users. Potential safety improvements can range from short-term to long-term improvements and should reference the 4 E's: Engineering; Education; Emergency Response; and Enforcement. This RSA evaluates the intersection of Falmouth Road (Route 28) and Santuit-Newtown Road in Barnstable, MA, as shown in Figure 1

The Cape Cod Commission (CCC) prepared a 2019 Barnstable County High Crash Locations report and the Cape Cod Crash Dashboard to view high crash locations. The Barnstable County High Crash Location report does not identify the intersection of Route 28 and Santuit-Newtown Road as a top crash location; however, the intersection was identified as a MassDOT Highway Safety Improvement Program (HSIP) high crash cluster for the 2013-2015 and the 2014-2016 periods. It should be noted that this intersection did not meet the criteria to be a MassDOT HSIP crash cluster for the 2015-2017. MassDOT defines an HSIP-eligible cluster as one in which the total number of "equivalent property damage only" (EPDO) crashes in the cluster is within the top 5% of all clusters in its respective regional planning agency. These high crash locations are then eligible for funding opportunities to improve safety after conducting an RSA.

Additionally, the Cape Cod Commission previously studied the intersection of Route 28 and Santuit-Newtown Road as part of the Route 28 Cotuit Corridor Study, completed in 2017. In the report, Commission staff studied three intersections: the intersections of Route 28 with Santuit-Newtown Road; Main Street; and Route 130. In that report, Commission staff recommended several actions/concepts for the intersection of Route 28 and Santuit-Newtown Road, one of which was conducting a roadway safety audit for the intersection.

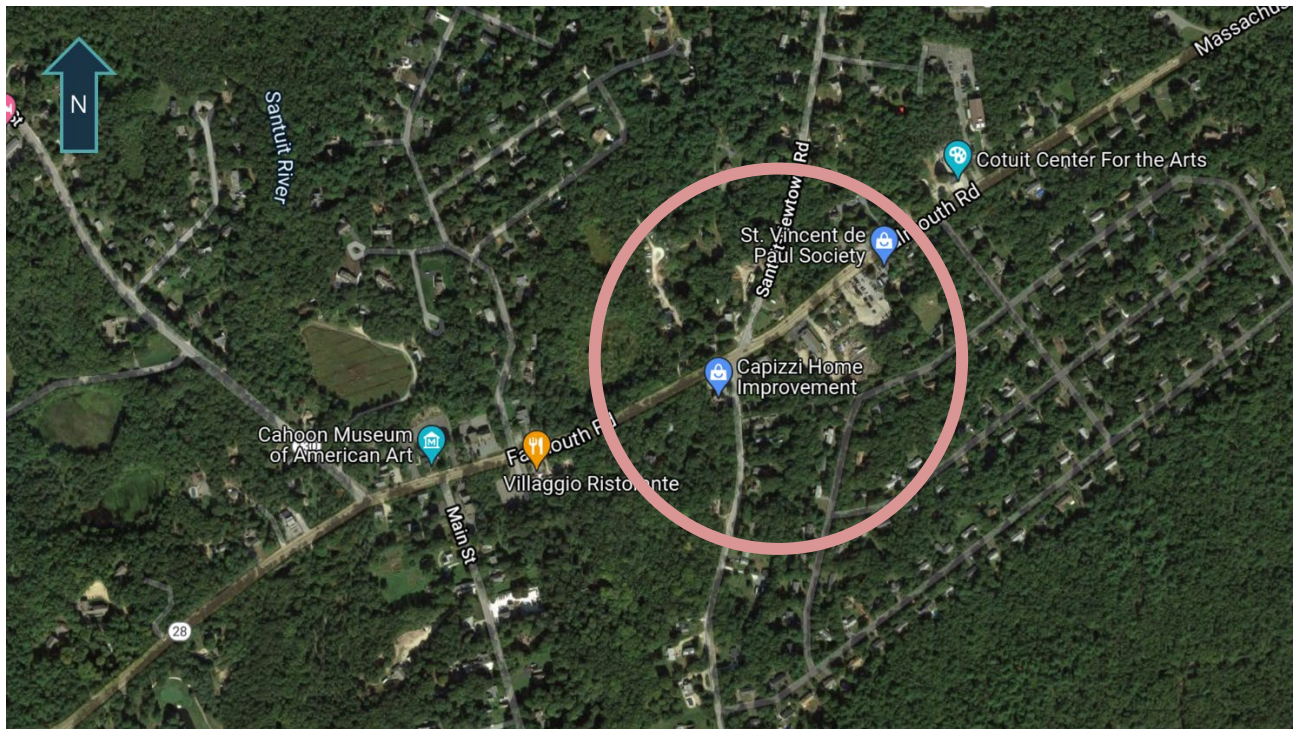


Figure 1: Locus Map

## Project Data

The RSA was held virtually on Thursday, December 9, 2021, with representatives from state, regional and local agencies and organizations providing expertise in the engineering, planning, maintenance, and emergency response fields. Attendees were encouraged to visit the site prior to the audit and to review the collision diagrams and crash summaries to become familiar with the existing safety issues. A copy of the RSA Agenda can be found in Appendix A. A list of the attendees is provided in Table 1 with their contact information provided in Appendix B.

**Table 1: Participating Audit Team Members**

<b>Audit Team Member</b>	<b>Agency/Affiliation</b>
Griffin Beaudoin	Town of Barnstable, Town Engineer
Nathan Collins	Town of Barnstable, Assistant Town Engineer
Elizabeth Jenkins	Town of Barnstable, Director of Planning and Development
Jessica Rapp Grasseti	Town of Barnstable Town Council, Barnstable Town Councilor - Precinct 7
Matthew Sonnabend	Barnstable Police Department, Police Chief
Matthew Lounsbury	Barnstable Police Department
Jonathan Brown	MassDOT Traffic Safety, Highway Safety Engineer
Dakota DelSignore	MassDOT Traffic Safety, Highway Safety Engineer
Robert Fitzgerald	MassDOT District 5
Ale Kuncaitis	MassDOT District 5
Barbara LaChance	MassDOT District 5, Transportation Planner
Bianca Marshall	MassDOT District 5 Traffic Operations
David Soares	MassDOT District 5 Traffic Operations, Traffic Operations Engineer
James Kummer	MassDOT District 5 Projects
Jason Walters	MassDOT District 5 Projects
Kip Diggs	Massachusetts House of Representatives, Representative, 2nd Barnstable District
Leah LaCross	Cape Cod Regional Transit Authority (CCRTA)
Sean Polay	Cape Cod Joint Transportation Committee, Bike Representative
Patty Daley	Cape Cod Commission
Colleen Medeiros	Cape Cod Commission
Evan Moorman	Cape Cod Commission
Dave Nolan	Cape Cod Commission
Steven Tupper	Cape Cod Commission

As a group, the team identified safety issues at the intersection. The RSA included a virtual field visit, which showed a collection of pre-recorded videos and photos depicting the existing operations and characteristics of the RSA location. The audit team finished the meeting by determining appropriate short, medium, and long-term countermeasures for the safety issues discussed.

## Project Location and Description

### *Study Area Roadways*

#### Falmouth Road (Route 28)

Falmouth Road (Route 28) is classified as an urban principal arterial running generally in a north-south direction, however within the study area Route 28 is oriented in an east-west direction and is denoted as such within this report. Throughout the study area, Route 28 is under MassDOT jurisdiction and has a regulatory 40 miles per hour (mph) limit per MassDOT Special Speed Regulation 326. Land use along Route 28 varies, with residential and commercial land uses in the general vicinity of the intersection.

The cross section along Route 28 is generally characterized by two 12-foot travel lanes (one in each direction) with 4-foot shoulders. There are no sidewalks or bike facilities on Route 28 in the vicinity of this intersection. The nearest section of sidewalk on Route 28 is to the west of the study intersection, between Sandalwood Drive and the east leg of Main Street. The Cape Cod Regional Transit Authority (CCRTA) provides bus service along Route 28 via the Sealine, which runs between Woods Hole and the Hyannis Transportation Center. There is no formal bus stop at the study intersection, but Sealine transit riders may flag down the bus anywhere along the Route 28 corridor.

#### Santuit-Newtown Road

Santuit-Newtown Road generally runs in a north-south direction throughout the study area. The road ultimately connects to Farmersville Road in Sandwich to the north and to Main Street in Cotuit to the south. Santuit-Newtown Road is a two-lane roadway under Town of Barnstable jurisdiction and is classified as an urban minor arterial north of Route 28 and an urban collector south of Route 28. This roadway primarily provides access to residential land uses.

The posted speed limit for Santuit-Newtown Road within the study area is 30 mph, but this is not supported by an approved special speed regulation. Consequently, Santuit-Newtown Road's speed limit is governed by Massachusetts General Law (MGL) Chapter 90.17 as a 30 mph "thickly settled" zone. The cross section along Santuit-Newtown Road varies, with the roadway generally consisting of two 11-foot travel lanes in each direction north of the intersection and two 12-foot travel lanes in each direction south of the intersection. On both approaches, there are nominal one-foot marked shoulders.

There is a sidewalk on the east side of Santuit-Newtown Road extending northerly from Route 28 to Lovell's Pond. There is no sidewalk present on Santuit-Newtown Road extending to the south of Route 28. No bicycle facilities are present, and there is no transit service along Santuit-Newtown Road.

### *Study Area Intersection*

#### Route 28 at Santuit-Newtown Road

Route 28 at Santuit-Newtown Road is a four-way unsignalized intersection. Northbound and southbound traffic is stop-controlled on Santuit-Newtown Road, while eastbound and westbound traffic on Route 28 is uncontrolled. Santuit-Newtown Road intersects Route 28 at a skewed angle from both directions which

results in large corner radii for right-turning vehicles. The intersection is also located just west of horizontal curve on Route 28. No turn lanes exist on any of the approaches. Lighting at the intersection is provided by a single cobra head located in the southeast corner.

As mentioned, there is a six-foot-wide asphalt sidewalk located on the eastern side of the northern approach of the intersection. There are no other sidewalks or marked crosswalks at the intersection. There are no bicycle accommodations provided on any approach. Though the intersection lacks an official CCRTA Sealine bus stop, riders have been noted to flag down the bus at and near this intersection as denoted by the dirt shoulder bus pull-offs east and west of the intersection.

### ***Speed Data***

Speed data just east of the intersection was measured by CCC Staff between 1:00 and 3:00 PM on Monday, September 20, 2021. The weather was sunny and dry. Speed data was collected using radar.

Westbound speeds are as follows:

- 95% of Speed: 44 mph
- 85% of Speed: 41 mph
- 50% of Speed (Median): 36 mph
- Mode: 36 mph

Eastbound speeds are as follows:

- 95% of Speed: 44 mph
- 85% of Speed: 40 mph
- 50% of Speed (Median): 37 mph
- Mode: 35 mph

### ***Traffic Volumes***

The Cape Cod Commission measured traffic volumes in June 2015 as part of the Route 28 Cotuit Corridor Study. Because those traffic volumes are now six years old, this RSA references figures from the Cape Cod Traffic Counting Report, which took the 2015 numbers and adjusted them to estimate 2018 figures (based on population growth, the growth in traffic measured at other locations, and other factors). In 2018, traffic volumes were estimated at the following location (Table 2):

**Table 2: Traffic Volume Data**

<b>Approach Roadway</b>	<b>2018 Annual Average Daily Traffic (AADT)</b>	<b>2018 Average Summer Daily Traffic</b>
Route 28 (west of Santuit-Newtown Road)	20,259	26,657
Route 28 (east of Santuit-Newtown Road)	21,356	28,100
Santuit-Newtown Road (south of Route 28)	1,151	1,514
Santuit-Newtown Road (north of Route 28)	2,022	2,660

INRIX traffic data was also reviewed to study recurring congestion and queuing in the vicinity of the study area intersection. Based on a review of 2019 traffic data from the intersection of Route 28 and Route 130/Main Street to the west, there was westbound queuing extending into the Santuit-Newton intersection approximately 225 out of 365 days.

Turning Movement Counts for the intersection were also conducted for the Route 28 Cotuit Corridor Study in 2015 during the weekday afternoon peak period of 4:00 PM to 5:30 PM. The peak hour of the turning movement counts was found to be 4:15 to 5:15 PM and is summarized below. A copy of the traffic count data can be found in Appendix C.

		Santuit-Newton Rd (North)				
		Right	Thru	Left		
		56	5	10		
Route 28 (West)	Left	92		42	Right	Route 28 (East)
	Thru	959		863	Thru	
	Right	1		42	Left	
		1	8	40		
		Left	Thru	Right		
		Santuit-Newton Rd (South)				

Figure 2: 2015 Weekday Afternoon Peak Hour Traffic Volumes



### ***Crash Data***

Crash reports were supplied by the Barnstable Police Department and supplemented with crash reports provided by MassDOT. The crash reports were reviewed, and a collision diagram was developed for the intersection. The crash diagram, the crash chart, and associated metrics, are provided in Appendix D.

#### Route 28 at Santuit-Newtown Road

The intersection of Route 28 and Santuit-Newtown Road experienced a total of 39 crashes with an average of eight (7.8) crashes per year over the five-year (2015-2019) study period. This study period reflects the latest closed data set based on MassDOT records. Twenty crashes (51%) were classified as rear-end crashes, 16 crashes (41%) were angle crashes, 2 crashes (5 %) were head on crashes, and one crash (less than 3%) was a single vehicle crash. As can be seen in the crash diagram, many of the angle crashes involved southbound vehicles on Santuit-Newtown Road turning left onto Route 28 colliding with Route 28 westbound vehicles. Rear-end crashes were also common, predominantly involving vehicles travelling westbound on Route 28.

There were no fatal injury crashes at this intersection within the study period. However, it was mentioned during the RSA that there was previously at least one fatal crash in an earlier time period and there is a strong level of community concern about this intersection. Additionally, there were no incapacitating injury crashes within the study period. However, 28% of the crashes resulted in a non-fatal injury with 10% of the crashes resulting in a non-incapacitating injury and 18% of crashes resulting in a “possible injury.” Crashes were dispersed throughout the year, with the top months being July and September (15% each), followed by April, August, and November with 13% each. Crashes were the highest in the three-month period of July-September which coincides with the heaviest traffic volumes during the summer peak period on Cape Cod. There were no crashes that involved a bicyclist or a pedestrian within the immediate area of the intersection. The most common times for crashes were between 4:00 and 6:00 PM (23%) followed by 10:00 AM to 12:00 PM (21%), and 8:00 AM to 10:00 AM (18%). Approximately 24% of the crashes were outside of daylight hours and 21% occurred during wet or snowy weather.

This intersection is identified as MassDOT Highway Safety Improvement Program (HSIP) crash cluster for the periods 2014-2016 and 2013-2015. Additionally, the crash rate for the intersection is 0.71 crashes per million entering vehicles, which is higher than the MassDOT District 5 and statewide average (both of which are 0.57 crashes per million entering vehicles for an unsignalized intersection).

## Audit Observations and Potential Safety Enhancements

The Road Safety Audit Team met virtually to discuss existing conditions, safety issues, and potential countermeasures. Items that were reviewed included a crash summary, collision diagram, RSA prompt list, a summary of safety trends for the intersection, and actual measured traffic speeds and volumes. The virtual RSA also included a review of video drone footage for the intersection, as well as a collection of dashboard camera videos of the intersection and all its approaches.

The following safety issues and potential enhancements were identified through the discussions with the Road Safety Audit team. Several of the issues require further study and engineering to determine the feasibility of implementing enhancements.

### **Safety Issue #1: Congestion & Intersection Operations**

#### **Observations:**

The Route 28 corridor is the only continuous corridor that stretches across the southern portion of the Cape (from Bourne to Orleans). Consequently, many unsignalized and signalized intersections along Route 28, including Route 28 at Santuit-Newtown Road, experience recurring congestion. Many participants pointed out that the congestion at this intersection is especially problematic because it varies dramatically throughout the day during peak- and off-peak times, and between summer and non-summer months, which is verified when reviewing INREX congestion data. During non-peak periods, there are often higher vehicle speeds observed along this segment of Route 28.



**Image 1: Route 28 congestion (drone view looking east)**

Westbound rear-end crashes occurred at various points within the intersection, ranging from downstream of the intersection, within the intersection, and upstream of the intersection. Route 28 westbound vehicle queues were noted to extend through the Santuit-Newtown Road intersection due to the downstream traffic signal located about a third of a mile west, at Route 28 at Route 130. Rear-ends also likely occurred as motorists were not aware of stopped traffic ahead due to limited visibility from a horizontal curve on Route 28 west of the intersection. Overall, there were 11 westbound rear-end crashes at the

intersection (or within close proximity), with five resulting in personal injury. The majority of Route 28 eastbound rear-end crashes occurred in advance of the intersection and may be due to Route 28 left turn vehicles queued at the intersection (Crashes #7, #32, and #35). Rear-end crashes are overrepresented in the summer when congestion is worse. Approximately 71% of rear-end crashes occurred during the summer peak (July-September), while only 51% of overall crashes were rear-ends in the study period.

Heavy congestion on Route 28, along with the lack of adequate gaps in traffic, may cause excessive delays which can lead to certain unsafe crossing and turning behaviors from drivers on Santuit-Newtown Road. For example, many participants mentioned that drivers, especially from the southbound approach, can become impatient and take insufficient gaps in traffic to make turns (or go straight). Participants noted that many drivers familiar with the area avoid making left turns at this intersection, due to this difficulty of this maneuver. This is reflected in the traffic count data where right turns from Santuit-Newtown Road are the predominant movement. Additionally, as a four-way unsignalized intersection, drivers exiting Santuit-Newtown Road must also anticipate the movement of an opposing vehicle on the other side of Santuit-Newtown Road when looking for an adequate gap in traffic. The lack of right-of-way assignment may lead to driver confusion and further hinder intersection operations.

Courtesy crashes were also noted as a common occurrence that resulted in angle collisions. Due to the difficulty of making a left-turn or through movement from Santuit-Newtown, commonly a vehicle stopped in traffic on Route 28 waves out a left-turning vehicle from Santuit-Newtown Road, with vehicles traveling the opposite direction on Route 28 remaining unaware of this turning movement. Courtesy crashes at this intersection include Crashes #13 and #20 where a southbound vehicle from Santuit-Newtown Road attempting a left turn onto Route 28 was waved on by an eastbound driver and was hit by vehicle traveling westbound on Route 28.

Finally, the high vehicle volumes and minimal gaps, along with the unsignalized nature of the intersection and lack of signal preemption, can cause delay to emergency responders on the intersection's minor legs.

**Enhancements:**

- Examine the possibility of adjusting signal timing (or otherwise improving traffic flow) at the Route 28/Route 130 intersection to reduce congestion and vehicle queues that extend to the study intersection.
- Install a traffic signal at the Route 28/Santuit-Newtown Road intersection to provide safe gaps in traffic, significantly reducing angle and “courtesy crashes.”<sup>1</sup> The traffic signal should also include emergency vehicle preemption and signalized pedestrian crossings.

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<sup>1</sup> Based on the traffic volume data measured in the peak season (summer), the eight-hour, four-hour, and peak-hour traffic signal warrants were satisfied as referenced in the Route 28 Cotuit Corridor Study.

## Safety Issue #2: Roadway Geometry

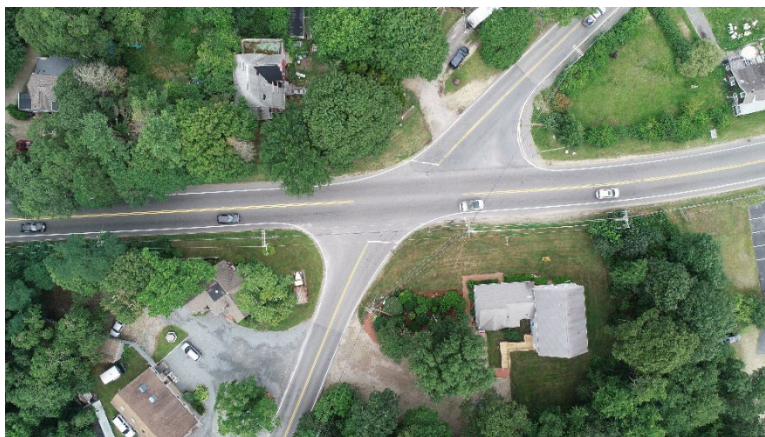
### Observations:

Several aspects of the existing roadway geometry and layout of the intersection are atypical and present challenges to vehicles trying to navigate the intersection

The intersection's skew angle and offset means that the distance that vehicles on Santuit-Newtown Road must travel across Route 28 is increased (as compared to a perpendicular intersection). These long crossing distances may cause drivers to misjudge the amount of time needed to cross the intersection. This could result in crashes, particularly angle crashes. The skewed nature of the intersection also means that vehicles on Santuit-Newtown Road going straight across Route 28 must often make a partial turn onto Route 28, (that complex maneuver contributed to Crash #22).

A similar issue with geometry occurs for vehicles on the minor approaches attempting to turn left. Because of the skew, drivers attempting these maneuvers must make obtuse (greater than 90 degrees) turns. Drivers require additional time to make this turn (compared with right angles) and may misjudge the gap required to complete it. Crashes #6, #11, #13, #18, and #20 all involved southbound drivers attempting a left turn onto Route 28 eastbound, and then being struck by westbound drivers on Route 28.

The skewed angle of the intersection results in large corner radii, most notably in the northeast quadrant, that creates additional area of pavement surface at the intersection. With the additional pavement at the corners of the intersection, vehicles on the minor approaches have been observed to queue side-by-side with one car attempting a right turn lane and the other attempting a left turn or a through movement. During this occurrence, sight lines are affected for each driver. Southbound left turning vehicles have been observed to encroach over the double-yellow centerline on the northern Santuit-Newtown Road



**Image 2: Drone view of the intersection, looking north**



**Image 3: A view of the wide corner radii in the northeast corner of the intersection**

approach in an attempt to improve their sight lines at a more conventional 90-degree angle. This may impede drivers attempting to go north on Santuit-Newtown Road.

Drivers on Route 28 also encounter safety issues related to the roadway geometry. The skewed nature of the intersection means that when drivers on Route 28 attempt a left turn onto Santuit-Newtown Road, drivers behind them often go around them, which can cause additional conflicts. One risk of this maneuver is that the passing driver can collide with vehicles edging out from the Santuit-Newtown Road. (see Crash #16).



**Image 4: An eastbound vehicle passing a left turning vehicle on the right-hand side**

Additionally, drivers turning left onto Route 28 from Santuit-Newtown Road suffer from poor sight lines. The horizontal curvature of Route 28 impedes sight lines between Santuit-Newtown Road southbound vehicles and Route 28 westbound vehicles. Crashes #25 and #28 are examples of right turn-

related crashes that may be due to poor sight lines. Drivers on Santuit-Newtown Road often creep out into Route 28 traffic to improve visibility, but that can cause other dangers, such as westbound vehicles swerving to avoid hitting the encroached vehicle (Crash #19).

Additionally, RSA participants noted that that Route 28 eastbound and westbound left turns cannot occur concurrently as the opposing left turn is often blocking the offset receiving lane on the minor roadway. The offset receiving lanes on Santuit Newtown Road require opposing vehicles to move beyond one another.

Finally, the roadway's geometry presents challenges for enforcement and emergency response. There are very narrow shoulders, which means police officers often cannot easily conduct speed patrols and there is lack of shoulder space for vehicles to pull over.

### **Enhancements**

- Consider installing a roundabout to better facilitate movements across Route 28.
- Consider installing an overhead flashing signal for increased awareness and improved visibility of the intersection for vehicles on Route 28.
- Examine the possibility of installing delta islands to ban left turns and/or through movements from Santuit-Newtown Road.
- Reconstruct the intersection to improve the roadway geometry to a more conventional 90-degree layout so that all approaches are perpendicular.

- Widen Route 28 to allow the creation of exclusive left turn lanes.
- On both approaches of Santuit-Newtown Road, consider narrowing the single lane width by striping a wider shoulder line to eliminate side-by-side queuing on this approach.
- Tighten curb radii at all the approaches to the intersection. Extending into Route 28, this would discourage or eliminate the ability of through-moving vehicles on Route 28 to pass on the right those attempting to turn left.
- Consider installing delineators on the double yellow centerline on both northbound and southbound approaches to prevent encroachment into opposite lanes.

### Safety Issue #3: Multi-Modal Accommodations

#### Observations:

RSA participants noted that multi-modal accommodations at this intersection are generally lacking, which creates an uncomfortable environment for potential users. There is a sidewalk located on the eastern side of Santuit-Newtown Road (northern approach only) that was noted to be overgrown with vegetation in some areas. The sidewalk ends at the Route 28 intersection with no other connections or accommodations. There are also no delineated bicycle accommodations (although shoulders are present on Route 28, as described earlier). Those shoulders, however, are not comfortable throughout the corridor for bicycling. RSA participants noted that the lack of pedestrian and bicyclist crashes at this intersection is likely due to pedestrians and bicyclists avoiding the intersection.

As mentioned earlier, Route 28 is served by the Sealine Route of the CCRTA. Buses stop on request east and west of the intersection, utilizing informal dirt pull-offs; however, there are no sidewalk accommodations for transit riders when accessing this intersection. It was also noted that eastbound buses, in particular, often pull over just east of the intersection. However, this pull-off is close to the intersection and is narrow; consequently, buses often block vehicles behind them, creating the potential for trailing vehicles to encroach on the opposing travel lane while passing.



**Image 5: Where the sidewalk ends on Santuit-Newtown Road**



**Image 6: Existing sidewalk on Santuit-Newtown Road to the north**

**Enhancements:**

- Remove overgrown vegetation along the existing Santuit-Newtown Road sidewalk.
- Install sidewalks where missing on all approaches of intersection.
- Consider identifying pedestrian desire lines and, if appropriate, install a crosswalk and curb ramps within the study area to safely accommodate pedestrians crossing Route 28. Evaluate treatments such as a Rectangular Rapid-Flashing Beacon (RRFB) for potential marked crosswalks.
- Consider a sidepath on Route 28 and a lower-level bicycle facility on Santuit-Newtown Road.
- Work with the CCRTA to explore installing permanent bus pull-off locations and bus stops on both sides of Route 28.



**Image 7: A View looking westward toward the intersection. Bus pullout for eastbound buses is in foreground. Note the lack of bicycle and pedestrian accommodations (except for shoulders)**



## Safety Issue #4: Lighting and Visibility

### Observations:

This intersection is characterized by several issues that impede visibility. First, the intersection is not well-lit, as there is only one light pole for the intersection located on the southeast corner. With 24% of crashes occurring outside of daytime hours, improved nighttime visibility could enhance the intersection's safety.

Secondly, there is significant vegetation on the northeast corner of the intersection, and to a lesser extent, other corners, which can impede visibility. Finally, the Capizzi Home Improvement sign on the southwest corner blocks sightlines for westbound drivers on Route 28 and northbound drivers on Santuit-Newtown Road who are preparing to turn left and travel straight.

Lastly, there was one crash (Crash #2) that may have been caused by large snowdrifts on the northeastern corner affecting sight lines on Santuit-Newtown Road (from the north) and blocking an oncoming (westbound) driver on Route 28.



**Image 8: View of the Capizzi Home Improvement sign (looking eastward)**

### Enhancements:

- Clear vegetation on all corners of the intersection with the northeast corner of the intersection being the highest priority.
- Consider installing improved intersection warning signage on Route 28, with flashing assemblies triggered by detectors. Options could include “Be Prepared to Stop” (for congestion on Route 28) or an Intersection Conflict Warning System (flashing when vehicles on Santuit-Newtown enter/cross 28).
- Add road name sign placards on advanced assemblies to ensure greater intersection visibility.
- Evaluate lighting and consider upgrading or installing additional street lighting.
- Relocate the Capizzi Home Improvement sign further back from the intersection.
- Coordinate with snowplow operators to ensure that any snowdrifts are of a limited height and are placed away from intersection corners.

## **Safety Issue #5: Drainage**

### **Observations:**

The crash summaries indicated there were two crashes explicitly connected to wet pavement issues (Crashes #8 and #27). Overall, nine (9) crashes occurred with suboptimal road surface conditions (rain or snow). Crash #8 was a rear-end collision in which the following vehicle was unable to stop for slowing traffic because of wet pavement, while Crash #27 was an angle crash in which a driver on Santuit-Newtown Road was unable to stop at the intersection because of wet pavement skidding.

### **Enhancements:**

- Investigate potential drainage issues throughout the intersection and identify possible improvements.

## Summary of Road Safety Audit

The final part of the RSA included the discussion of potential safety enhancements to address the identified safety deficiencies. The range of safety enhancements included both short-term, low-cost improvements as well as long-term and higher cost recommendations. Table 3 presents a summary of the estimated time frames and preliminary costs associated with each potential safety enhancement.

Table 3 presents a summary of the Road Safety Audit observations and enhancements to assist in the design and/or implementation of potential improvements elicited during the process. It is also recommended that any design process for more involved geometric changes include further analysis and public input. Safety payoff estimates are subjective judgement of the potential effectiveness of the potential enhancement.

**Table 3: Estimated Time Frame and Costs Breakdown**

Time Frame		Costs	
Short-Term	<1 Year	Low	<\$10,000
Mid-Term	1-3 Years	Medium	\$10,001-\$50,000
Long-Term	>3 Years	High	>\$50,000

Table 4: Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Congestion & Intersection Operations	Examine the possibility of adjusting signal timing (or otherwise improving traffic flow) at the Route 28 / Route 130 intersection.	Medium	Short-Term	Low	MassDOT
Congestion & Intersection Operations	Install a traffic signal to provide safe gaps in traffic. The traffic signal should include emergency vehicle preemption and signalized pedestrian crossings.	High	Long-Term	High	MassDOT
Roadway Geometry	Consider installing a roundabout to reduce the prevalence of high-speed angle crashes.	High	Long-Term	High	MassDOT/Town
Roadway Geometry	Consider installing an overhead flashing signal for improved intersection visibility for drivers on Route 28.	Medium	Mid-Term	Medium	MassDOT
Roadway Geometry	Examine the possibility of installing delta islands to ban left turns and/or through movements from Santuit-Newtown Road.	High	Mid-Term	Medium	MassDOT/Town
Roadway Geometry	Reconstruct the intersection to improve the roadway geometry to a more conventional 90-degree layout so that all approaches are perpendicular.	Medium	Long-Term	High	MassDOT/Town
Roadway Geometry	Widen Route 28 to allow the creation of exclusive left turn lanes.	Medium	Long-Term	High	MassDOT/Town
Roadway Geometry	On both approaches of Santuit-Newtown Road, consider re-striping the single travel lane with a wider shoulder area to deter side-by-side queuing.	Low	Short-Term	Low	Town
Roadway Geometry	Tighten curb radii at all approaches to the intersection.	Medium	Mid-Term	Medium	MassDOT/Town

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Roadway Geometry	Consider installing delineators on DYCLs on both northbound and southbound approaches to prevent encroachment into opposite lanes.	Low	Short-Term	Low	Town
Multi-Modal Accommodations	Remove overgrown vegetation along Santuit-Newtown Road sidewalk.	Low	Short-Term	Low	Town
Multi-Modal Accommodations	Install missing sidewalks on all approaches of intersection.	Medium	Long-Term	High	MassDOT/Town
Multi-Modal Accommodations	Consider identifying pedestrian desire lines and, if appropriate, providing a crosswalk and curb ramps within the study area to safely accommodate pedestrians crossing Route 28. Evaluate treatments such as RFB for potential marked crosswalks.	High	Long-Term	High	MassDOT
Multi-Modal Accommodations	Consider a sidepath on Route 28 and a lower-level bicycle facility on Santuit-Newtown Road.	High	Long-Term	High	MassDOT/Town
Multi-Modal Accommodations	Work with the CCRTA to explore installing permanent bus pull-offs and bus stops on both sides of Route 28.	Medium	Mid-Term	Medium	CCRTA/MassDOT
Lighting and Visibility	Clear vegetation on all corners of the intersection, with the northeast corner being the highest priority.	Medium	Short-Term	Low	MassDOT/Town
Lighting and Visibility	Consider installing improved intersection warning signage on Route 28, with flashing assemblies triggered by detectors. Options could include “Be Prepared to Stop” (for congestion on Route 28) or an Intersection Conflict Warning System (flashing when vehicles on Santuit-Newtown Road enter/cross Route 28).	High	Short-Term	Medium	MassDOT

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Jurisdiction
Lighting and Visibility	Add road name sign placards on advanced assemblies to ensure greater intersection visibility.	Low	Short-Term	Low	MassDOT/Town
Lighting and Visibility	Evaluate lighting and consider upgrading or installing additional street lighting.	Medium	Mid-Term	Medium	MassDOT/Town
Lighting and Visibility	Relocate the Capizzi Home Improvement sign further back from the intersection.	Medium	Short-Term	Low	MassDOT/Town
Lighting and Visibility	Coordinate with snowplow operators to ensure that any snowdrifts are of a limited height and are placed away from intersection corners.	Low	Short-Term	Low	MassDOT/Town
Drainage	Investigate potential drainage issues throughout the intersection and identify possible improvements.	Medium	Mid-Term	Medium	MassDOT/Town

## Appendix A. RSA Meeting Agenda

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# Agenda

## Road Safety Audit

Barnstable, MA

Route 28 at Santuit-Newtown Road

ZOOM Link: <https://capecodcommission.org/transportation/join>

Thursday, December 9, 2021

1:00PM – 4:00PM

Type of meeting:	High crash location – Road Safety Audit
Attendees:	Invited participants to comprise a multidisciplinary team
Please bring:	Thoughts and enthusiasm!!

1:00 PM	<b>Welcome and Introductions</b>
1:15 PM	<b>Discussion of Safety Issues</b> <ul style="list-style-type: none"><li>• Crash history, speed regulations, recent and existing projects – all provided in advance</li><li>• Existing geometries and conditions</li></ul>
2:15 PM	<b>Virtual Site Visit</b> <ul style="list-style-type: none"><li>• View video footage of intersection and corridor</li><li>• As a group, identify areas for improvement</li></ul>
3:00 PM	<b>Discussion of Potential Improvements</b> <ul style="list-style-type: none"><li>• Discuss observations and finalize safety issue areas</li><li>• Discuss potential improvements and finalize recommendations</li></ul>
4:00 PM	<b>Adjourn for the Day – but the RSA has not ended</b>

### Instructions for Participants:

- Before attending the RSA on December 9, 2021, participants are encouraged to drive/walk through the intersection and complete/consider elements on the RSA Prompt List with a focus on safety.
- All participants will be actively involved in the process throughout. Participants are encouraged to come with thoughts and ideas, but are reminded that the synergy that develops and respect for others' opinions are key elements to the success of the overall RSA process.
- After the RSA meeting, participants will be asked to comment and respond to the document materials to assure it is reflective of the RSA completed by the multidisciplinary team.



## Appendix B. RSA Audit Team Contact List

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## Participating Audit Team Members

Date: Dec 9, 2021      Location: Online (Zoom meeting)

<b>Audit Team Members</b>	<b>Agency/Affiliation</b>	<b>Email Address</b>
Griffin Beaudoin	Town of Barnstable, Town Engineer	<a href="mailto:griffin.beaudoin@town.barnstable.ma.us">griffin.beaudoin@town.barnstable.ma.us</a>
Nathan Collins	Town of Barnstable, Assistant Town Engineer	<a href="mailto:Nathan.collins@town.barnstable.ma.us">Nathan.collins@town.barnstable.ma.us</a>
Elizabeth Jenkins	Town of Barnstable, Director of Planning and Development	<a href="mailto:Elizabeth.jenkins@town.barnstable.ma.us">Elizabeth.jenkins@town.barnstable.ma.us</a>
Jessica Rapp Grasseti	Town of Barnstable Town Council, Barnstable Town Councilor - Precinct 7	precinct7@comcast.net
Matthew Sonnabend	Barnstable Police Department, Police Chief	<a href="mailto:sonnabendm@barnstablepolice.com">sonnabendm@barnstablepolice.com</a>
Matthew Lounsbury	Barnstable Police Department	<a href="mailto:lounsburym@barnstablepolice.com">lounsburym@barnstablepolice.com</a>
Jonathan Brown	MassDOT Traffic Safety, Highway Safety Engineer	<a href="mailto:jonathan.a.brown@dot.state.ma.us">jonathan.a.brown@dot.state.ma.us</a>
Dakota DelSignore	MassDOT Traffic Safety, Highway Safety Engineer	<a href="mailto:Dakota.D.DelSignore@dot.state.ma.us">Dakota.D.DelSignore@dot.state.ma.us</a>
Robert Fitzgerald	MassDOT District 5	<a href="mailto:robert.fitzgerald@state.ma.us">robert.fitzgerald@state.ma.us</a>
Ale Kuncaitis	MassDOT District 5	<a href="mailto:ale.kuncaitis@state.ma.us">ale.kuncaitis@state.ma.us</a>
Barbara LaChance	MassDOT District 5, Transportation Planner	<a href="mailto:barbara.lachance@state.ma.us">barbara.lachance@state.ma.us</a>
Bianca Marshall	MassDOT District 5 Traffic Operations	<a href="mailto:Bianca.Marshall@dot.state.ma.us">Bianca.Marshall@dot.state.ma.us</a>
David Soares	MassDOT District 5 Traffic Operations Engineer	<a href="mailto:david.soares@dot.state.ma.us">david.soares@dot.state.ma.us</a>
James Kummer	MassDOT District 5 Projects	<a href="mailto:James.kummer@dot.state.ma.us">James.kummer@dot.state.ma.us</a>
Jason Walters	MassDOT District 5 Projects	<a href="mailto:jason.walters@state.ma.us">jason.walters@state.ma.us</a>
Kip Diggs	Massachusetts House of Representatives, Representative, 2nd Barnstable District	<a href="mailto:Kip.Diggs@mahouse.gov">Kip.Diggs@mahouse.gov</a>
Leah LaCross	Cape Cod Regional Transit Authority (CCRTA)	<a href="mailto:llacross@capecodrta.org">llacross@capecodrta.org</a>
Sean Polay	Cape Cod Joint Transportation Committee, Bike Representative	<a href="mailto:sean.polay@gmail.com">sean.polay@gmail.com</a>
Patty Daley	Cape Cod Commission	<a href="mailto:pdaley@capecodcommission.org">pdaley@capecodcommission.org</a>
Colleen Medeiros	Cape Cod Commission	<a href="mailto:colleen.medeiros@capecodcommission.org">colleen.medeiros@capecodcommission.org</a>
Evan Moorman	Cape Cod Commission,	<a href="mailto:evan.moorman@capecodcommission.org">evan.moorman@capecodcommission.org</a>
Dave Nolan	Cape Cod Commission	<a href="mailto:david.nolan.capecodcommission.org">david.nolan.capecodcommission.org</a>
Steven Tupper	Cape Cod Commission	<a href="mailto:stupper@capecodcommission.org">stupper@capecodcommission.org</a>

## Appendix C. Count Data

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# Cape Cod Commission

3225 Main Street, Barnstable, MA, 02630

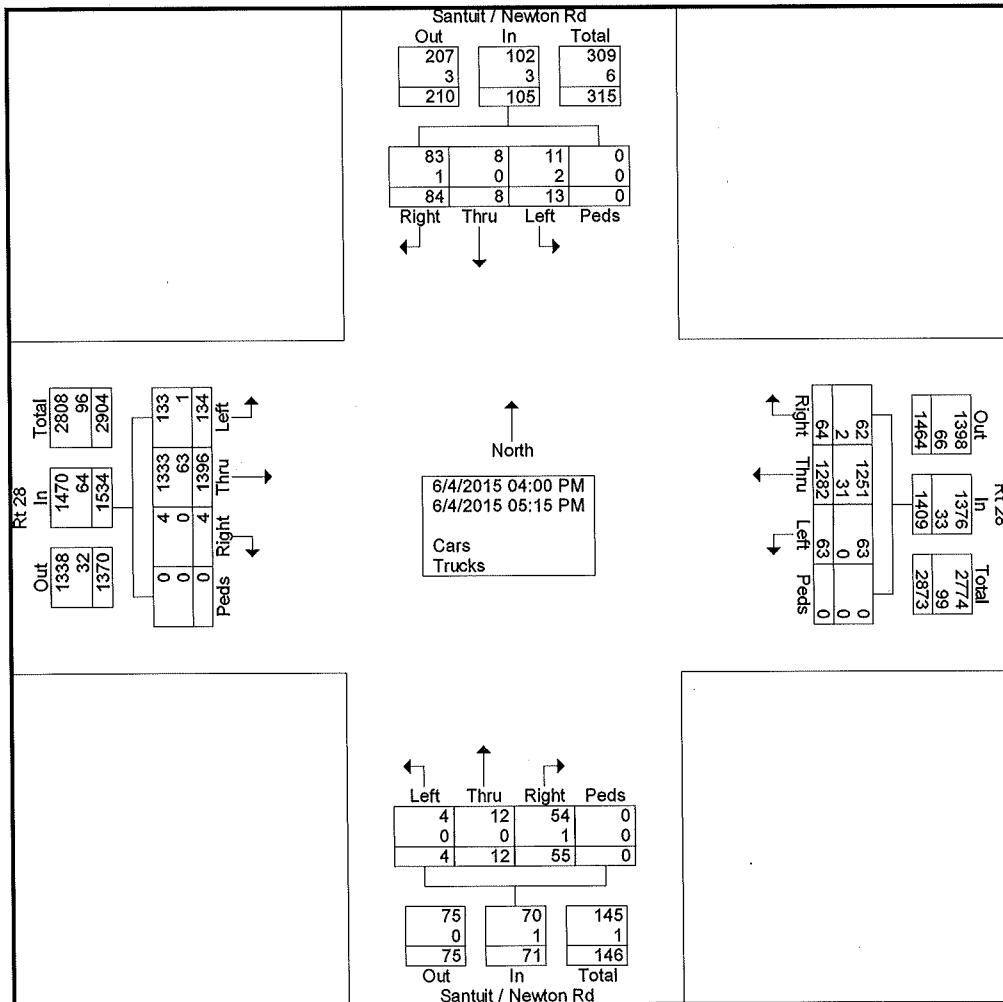
[www.capecodcommission.org](http://www.capecodcommission.org)

Location: RT 28 @ Newton Rd  
 Town: Barnstable  
 Counted by: AR & JW  
 Counters: 5 & 6

File Name : 2960\_06042015  
 Site Code : 2960  
 Start Date : 6/4/2015  
 Page No : 1

### Groups Printed- Cars - Trucks

Start Time	Santuit / Newton Rd From North					Rt 28 From East					Santuit / Newton Rd From South					Rt 28 From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	2	1	18	0	21	9	210	8	0	227	2	2	7	0	11	20	250	2	0	272	531
04:15 PM	1	1	11	0	13	9	201	12	0	222	1	2	8	0	11	15	239	1	0	255	501
04:30 PM	2	1	15	0	18	14	213	15	0	242	0	0	6	0	6	30	225	0	0	255	521
04:45 PM	4	3	22	0	29	9	219	5	0	233	0	0	14	0	14	24	245	0	0	269	545
<b>Total</b>	<b>9</b>	<b>6</b>	<b>66</b>	<b>0</b>	<b>81</b>	<b>41</b>	<b>843</b>	<b>40</b>	<b>0</b>	<b>924</b>	<b>3</b>	<b>4</b>	<b>35</b>	<b>0</b>	<b>42</b>	<b>89</b>	<b>959</b>	<b>3</b>	<b>0</b>	<b>1051</b>	<b>(2098)</b>
05:00 PM	3	0	8	0	11	10	230	10	0	250	0	6	12	0	18	23	250	0	0	273	552
05:15 PM	1	2	10	0	13	12	209	14	0	235	1	2	8	0	11	22	187	1	0	210	469
Grand Total	13	8	84	0	105	63	1282	64	0	1409	4	12	55	0	71	134	1396	4	0	1534	3119
Apprch %	12.4	7.6	80	0		4.5	91	4.5	0		5.6	16.9	77.5	0		8.7	91	0.3	0		
Total %	0.4	0.3	2.7	0	3.4	2	41.1	2.1	0	45.2	0.1	0.4	1.8	0	2.3	4.3	44.8	0.1	0	49.2	
Cars	11	8	83	0	102	63	1251	62	0	1376	4	12	54	0	70	133	1333	4	0	1470	3018
% Cars	84.6	100	98.8	0	97.1	100	97.6	96.9	0	97.7	100	100	98.2	0	98.6	99.3	95.5	100	0	95.8	96.8
Trucks	2	0	1	0	3	0	31	2	0	33	0	0	1	0	1	1	63	0	0	64	101
% Trucks	15.4	0	1.2	0	2.9	0	2.4	3.1	0	2.3	0	0	1.8	0	1.4	0.7	4.5	0	0	4.2	3.2



# Cape Cod Commission

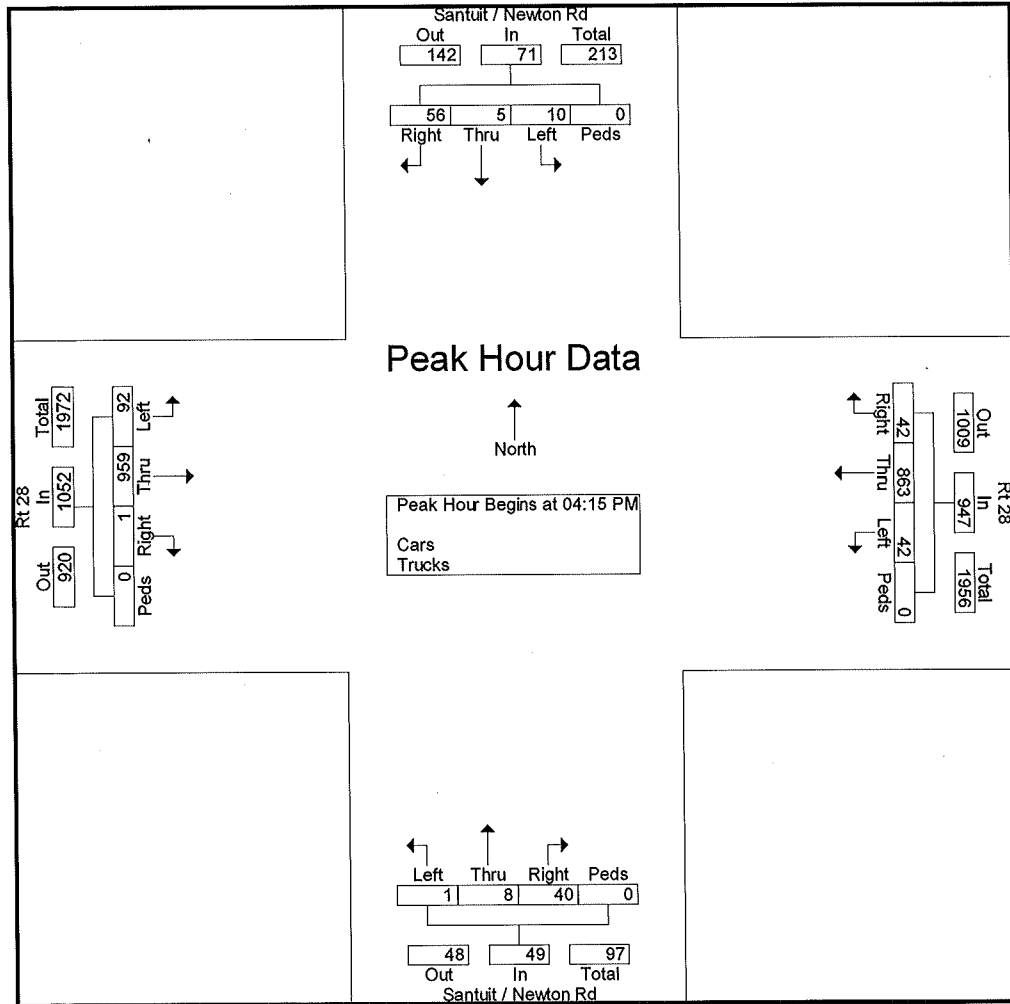
3225 Main Street, Barnstable, MA, 02630

[www.capecodcommission.org](http://www.capecodcommission.org)

Location: RT 28 @ Newton Rd  
 Town: Barnstable  
 Counted by: AR & JW  
 Counters: 5 & 6

File Name : 2960\_06042015  
 Site Code : 2960  
 Start Date : 6/4/2015  
 Page No : 2

Start Time	Santuit / Newton Rd From North					Rt 28 From East					Santuit / Newton Rd From South					Rt 28 From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 04:00 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM ←																					
04:15 PM	1	1	11	0	13	9	201	12	0	222	1	2	8	0	11	15	239	1	0	255	501
04:30 PM	2	1	15	0	18	14	213	15	0	242	0	0	6	0	6	30	225	0	0	255	521
04:45 PM	4	3	22	0	29	9	219	5	0	233	0	0	14	0	14	24	245	0	0	269	545
05:00 PM	3	0	8	0	11	10	230	10	0	250	0	6	12	0	18	23	250	0	0	273	552
Total Volume	10	5	56	0	71	42	863	42	0	947	1	8	40	0	49	92	959	1	0	1052	2119
% App. Total	14.1	7	78.9	0		4.4	91.1	4.4	0		2	16.3	81.6	0		8.7	91.2	0.1	0		
PHF	.625	.417	.636	.000	.612	.750	.938	.700	.000	.947	.250	.333	.714	.000	.681	.767	.959	.250	.000	.963	.960



# Cape Cod Commission

3225 Main Street, Barnstable, MA, 02630

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Location: RT 28 @ Newton Rd  
 Town: Barnstable  
 Counted by: AR & JW  
 Counters: 5 & 6

File Name : 2960\_06042015  
 Site Code : 2960  
 Start Date : 6/4/2015  
 Page No : 1

### Groups Printed- Cars

Start Time	Santuit / Newton Rd From North					Rt 28 From East					Santuit / Newton Rd From South					Rt 28 From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	2	1	18	0	21	9	201	8	0	218	2	2	7	0	11	19	232	2	0	253	503
04:15 PM	1	1	11	0	13	9	195	12	0	216	1	2	7	0	10	15	225	1	0	241	480
04:30 PM	2	1	15	0	18	14	204	15	0	233	0	0	6	0	6	30	220	0	0	250	507
04:45 PM	4	3	21	0	28	9	216	5	0	230	0	0	14	0	14	24	235	0	0	259	531
<b>Total</b>	<b>9</b>	<b>6</b>	<b>65</b>	<b>0</b>	<b>80</b>	<b>41</b>	<b>816</b>	<b>40</b>	<b>0</b>	<b>897</b>	<b>3</b>	<b>4</b>	<b>34</b>	<b>0</b>	<b>41</b>	<b>88</b>	<b>912</b>	<b>3</b>	<b>0</b>	<b>1003</b>	<b>2021</b>
05:00 PM	2	0	8	0	10	10	226	10	0	246	0	6	12	0	18	23	240	0	0	263	537
05:15 PM	0	2	10	0	12	12	209	12	0	233	1	2	8	0	11	22	181	1	0	204	460
<b>Grand Total</b>	<b>11</b>	<b>8</b>	<b>83</b>	<b>0</b>	<b>102</b>	<b>63</b>	<b>1251</b>	<b>62</b>	<b>0</b>	<b>1376</b>	<b>4</b>	<b>12</b>	<b>54</b>	<b>0</b>	<b>70</b>	<b>133</b>	<b>1333</b>	<b>4</b>	<b>0</b>	<b>1470</b>	<b>3018</b>
<b>Apprch %</b>	<b>10.8</b>	<b>7.8</b>	<b>81.4</b>	<b>0</b>		<b>4.6</b>	<b>90.9</b>	<b>4.5</b>	<b>0</b>		<b>5.7</b>	<b>17.1</b>	<b>77.1</b>	<b>0</b>		<b>9</b>	<b>90.7</b>	<b>0.3</b>	<b>0</b>		
<b>Total %</b>	<b>0.4</b>	<b>0.3</b>	<b>2.8</b>	<b>0</b>	<b>3.4</b>	<b>2.1</b>	<b>41.5</b>	<b>2.1</b>	<b>0</b>	<b>45.6</b>	<b>0.1</b>	<b>0.4</b>	<b>1.8</b>	<b>0</b>	<b>2.3</b>	<b>4.4</b>	<b>44.2</b>	<b>0.1</b>	<b>0</b>	<b>48.7</b>	

# Cape Cod Commission

3225 Main Street, Barnstable, MA, 02630

[www.capecodcommission.org](http://www.capecodcommission.org)

Location: RT 28 @ Newton Rd  
 Town: Barnstable  
 Counted by: AR & JW  
 Counters: 5 & 6

File Name : 2960\_06042015  
 Site Code : 2960  
 Start Date : 6/4/2015  
 Page No : 1

Groups Printed- Trucks

Start Time	Santuit / Newton Rd From North					Rt 28 From East					Santuit / Newton Rd From South					Rt 28 From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	0	0	0	0	0	0	9	0	0	9	0	0	0	0	0	1	18	0	0	19	28
04:15 PM	0	0	0	0	0	0	6	0	0	6	0	0	1	0	1	0	14	0	0	14	21
04:30 PM	0	0	0	0	0	0	9	0	0	9	0	0	0	0	0	0	5	0	0	5	14
04:45 PM	0	0	1	0	1	0	3	0	0	3	0	0	0	0	0	0	10	0	0	10	14
<b>Total</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>27</b>	<b>0</b>	<b>0</b>	<b>27</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>47</b>	<b>0</b>	<b>0</b>	<b>48</b>	<b>77</b>
05:00 PM	1	0	0	0	1	0	4	0	0	4	0	0	0	0	0	0	10	0	0	10	15
05:15 PM	1	0	0	0	1	0	0	2	0	2	0	0	0	0	0	0	6	0	0	6	9
Grand Total	2	0	1	0	3	0	31	2	0	33	0	0	1	0	1	1	63	0	0	64	101
Apprch %	66.7	0	33.3	0		0	93.9	6.1	0		0	0	100	0		1.6	98.4	0	0		
Total %	2	0	1	0	3	0	30.7	2	0	32.7	0	0	1	0	1	1	62.4	0	0	63.4	

# Cape Cod Commission

3225 Main Street, Barnstable, MA, 02630

[www.capecodcommission.org](http://www.capecodcommission.org)

Location: RT 28 @ Newton Rd

Town: Barnstable

Counted by: AR & JW

Counters: 5 & 6

File Name : 2960\_06042015

Site Code : 2960

Start Date : 6/4/2015

Page No : 1

### Groups Printed- Bikes

Start Time	Santuit / Newton Rd From North					Rt 28 From East					Santuit / Newton Rd From South					Rt 28 From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
*** BREAK ***																					
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
Grand Total	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
Apprch %	0	0	0	0	0	0	0	0	0	0	0	100	0	0	100	0	0	0	0	0	
Total %	0	0	0	0	0	0	0	0	0	0	0	100	0	0	100	0	0	0	0	0	

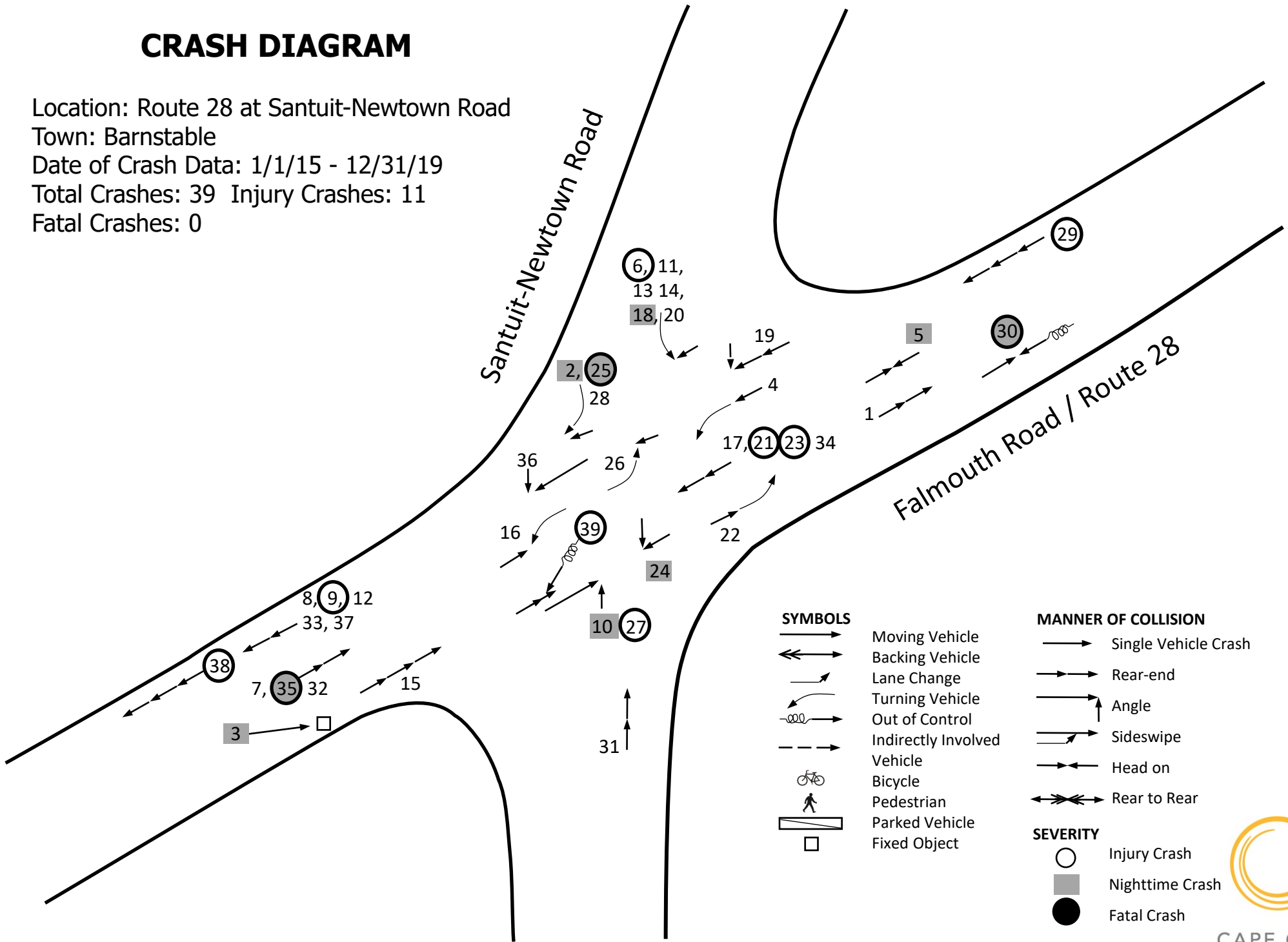


## Appendix D. Detailed Crash Data

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# CRASH DIAGRAM

Location: Route 28 at Santuit-Newtown Road  
 Town: Barnstable  
 Date of Crash Data: 1/1/15 - 12/31/19  
 Total Crashes: 39 Injury Crashes: 11  
 Fatal Crashes: 0



SYMBOLS		MANNER OF COLLISION	
	Moving Vehicle		Single Vehicle Crash
	Backing Vehicle		Rear-end
	Lane Change		Angle
	Turning Vehicle		Sideswipe
	Out of Control		Head on
	Indirectly Involved Vehicle		Rear to Rear
	Bicycle		
	Pedestrian		
	Parked Vehicle		
	Fixed Object		
<b>SEVERITY</b>			Injury Crash
			Nighttime Crash
			Fatal Crash

## Crash Data Summary Table

Route 28 at Santuit Newtown Road, Barnstable, MA  
2015-2019

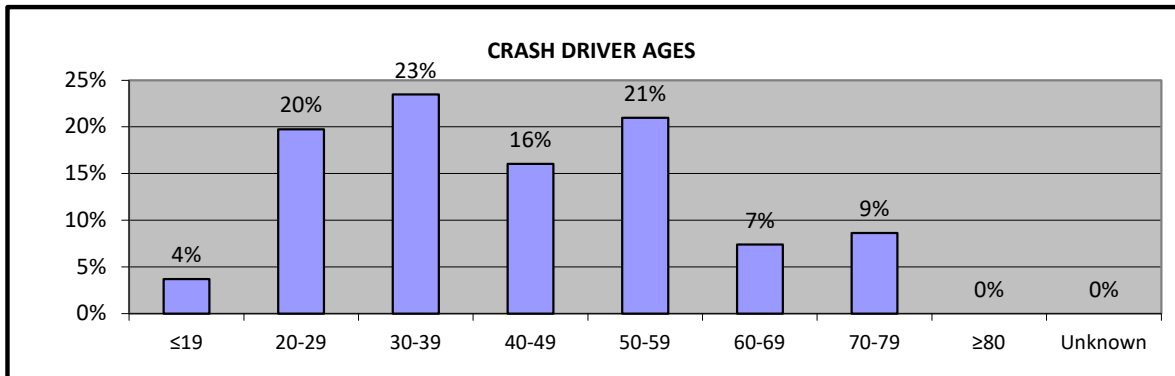
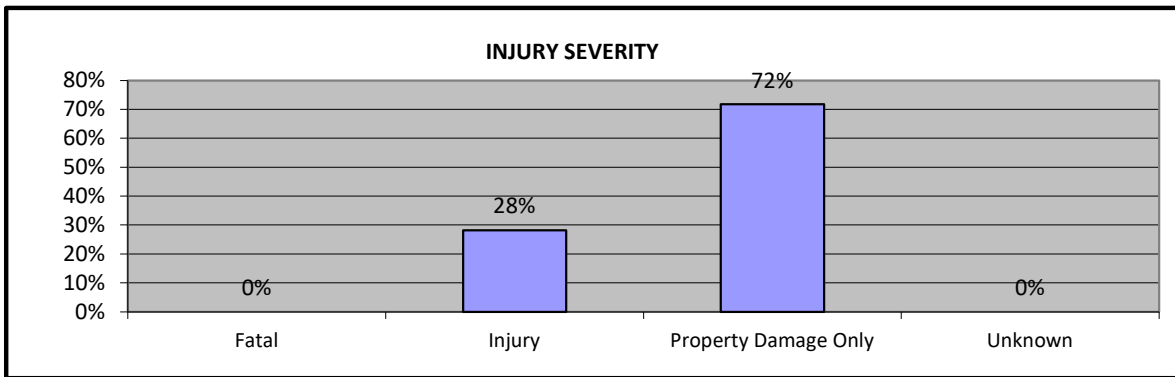
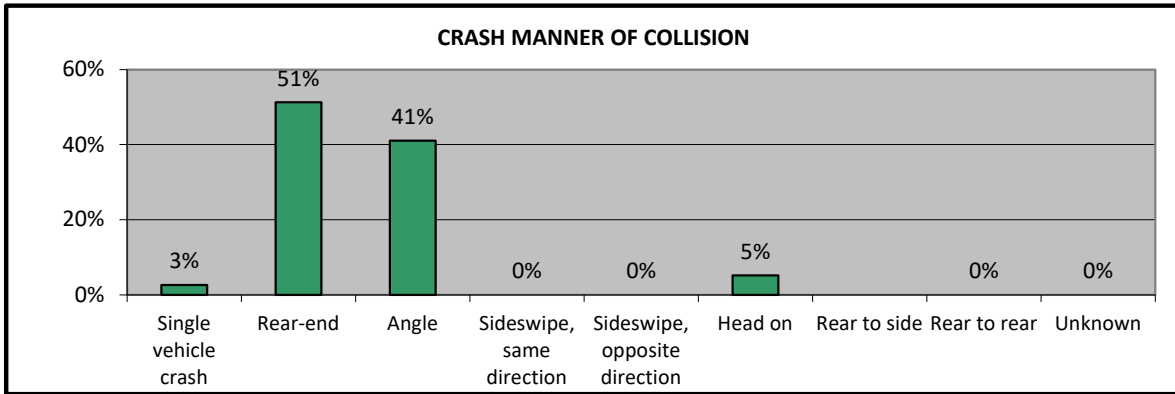
Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Injury Severity	D1 Age	D2 Age	D3 Age	D4 Age	Comments
#	mm/dd/yy	Day	hh:mm	Type	Type	Type	Type	Type	Type	#	#	#	#	
1	01/21/15	Wednesday	11:19 AM	Rear-end	Daylight	Clear	Dry	Inattention	No Injury	26	51			MV1 and MV2 were heading east on Route 28, just east of the intersection with Santuit-Newtown Road. MV2 was stopped in traffic and MV1 rear-ended MV2.
2	02/05/15	Thursday	8:03 PM	Angle	Dark - lighted roadway	Clear	Dry	Inattention	No Injury	48	60			MV1 was driving west along Route 28 at about 40 mph when MV2 turned right (west) onto Route 28 from the north-facing stop sign at Santuit Newtown Road. It appears that MV2 was distracted due to limited visibility from large snow back in NE corner.
3	03/20/15	Friday	6:26 PM	Single vehicle crash	Dark - lighted roadway	Snow	Snow	Driving too fast for conditions	No Injury	17				MV1 was driving east on Route 28 approaching the intersection when traffic in front of MV1 abruptly stopped. MV1 attempted to stop but was unable to due to snowy roadway, MV1 swerved to the right and struck a utility pole.
4	04/03/15	Friday	5:45 PM	Rear-end	Daylight	Cloudy	Wet	Inattention	No Injury	18	21			MV2 was travelling west on Route 28, attempting to make a left turn onto Santuit/Newtown Road when MV1 struck MV2 from behind.
5	04/29/15	Wednesday	8:45 PM	Head on	Dark - lighted roadway	Clear	Dry	Other improper action	No Injury	39	37			MV1 was traveling east on Route 28 when he braked for a vehicle stopping ahead. When he braked, his car slid into the other (opposing) lane over the center line, without warning, striking head-on a car traveling west on Route 28. Operator of MV1 was arrested for OUI.
6	05/01/15	Friday	7:39 AM	Angle	Daylight	Clear	Dry	Failed to yield right of way	Non-fatal injury	48	54			MV1 was stopped on Santuit/Newtown Road southbound attempting to turn left onto Route 28 and began to pull out onto Route 28 when there was a break in traffic. MV2 was travelling westbound on Route 28 and did not have time to stop to avoid the collision.
7	06/24/15	Wednesday	5:15 PM	Rear-end	Daylight	Clear	Dry	Operating defective equipment	No Injury	45	43			MV1 and MV2 were traveling east on Route 28 toward Santuit Newtown Road. MV2 slowed down and stopped for traffic ahead; MV1 applied their brakes, but they did not work and rear-ended MV2 driver.
8	07/01/15	Wednesday	11:47 AM	Rear-end	Daylight	Rain	Wet	Inattention	No Injury	79	57			MV1 and MV2 were both traveling west on Route 28 just west of the intersection with Santuit-Newtown Road. MV1 slowed down due to traffic ahead. MV2 braked and rear-ended MV1 due to possible wet pavement issues.
9	07/20/15	Monday	12:23 PM	Rear-end	Daylight	Clear	Dry	Inattention	Non-fatal injury	30	71			MV2 and MV1 were traveling west on Route 28 just west of Santuit-Newtown Road. MV1 stopped and then slowed in response to traffic ahead and MV2 was unable to stop in time, leading to a rear-end crash.
10	08/06/15	Thursday	10:53 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	No Injury	64	26			MV2 was traveling east on Route 28 at intersection with Santuit-Newtown Road. MV1 was stopped on south side of intersection, attempting to cross road to north side. MV1 apparently didn't see MV2 and collided with the right side of MV2.
11	08/29/15	Saturday	5:12 PM	Angle	Daylight	Clear	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner; Failed to yield right of way	No Injury	29	79			MV1 was making a left turn onto Route 28 East from Santuit-Newtown Road Southbound and collided with MV2, who was traveling west on Route 28.
12	09/30/15	Wednesday	9:24 AM	Rear-end	Daylight	Rain	Wet	Failed to yield right of way	No Injury	72	43			MV1 stopped on Santuit-Newtown Road southbound, did not see any vehicles and proceeded to turn right onto Route 28 west. MV1 had pulled in front of MV2, a tractor-trailer who was traveling west on Rte 28, causing the rear-end collision.
13	11/09/15	Monday	9:30 AM	Angle	Daylight	Cloudy	Dry	Failed to yield right of way	No Injury	26	58			MV1 was stopped on Santuit/Newtown Road (from the north) attempting to turn left onto Route 28 and began to pull out onto Route 28 as a vehicle travelling eastbound stopped to let MV1 go. MV2, traveling westbound, was struck by MV1 who failed to yield the right of way.
14	03/15/16	Tuesday	11:56 AM	Angle	Daylight	Rain	Wet	Failed to yield right of way	No Injury	57	37			MV1 was traveling southbound on Santuit/Newtown Road and attempting to make a left turn onto Route 28 and collided with MV 2 who was travelling westbound on Route 28. The driver of MV1 believed that MV2 had their right turn signal on.
15	04/30/16	Saturday	10:01 AM	Rear-end	Daylight	Clear	Dry	Inattention	No Injury	33	64	51		MV3 and MV2 were stopped in traffic in the eastbound lane of Route 28. MV1 did not realize traffic was stopped and rear-ended MV2, which then was pushed into MV3.
16	07/08/16	Friday	12:22 PM	Angle	Daylight	Cloudy	Dry	No improper driving	No Injury	44	22			MV1 was traveling east on Route 28 and decided to go around a stopped vehicle who was waiting to make a left turn but subsequently hit MV2 who was attempting to turn left onto Santuit-Newtown Road from Route 28 westbound.
17	08/19/16	Friday	8:48 AM	Rear-end	Daylight	Clear	Dry	Inattention	No Injury	41	25			MV2 was located in front of MV1, with both cars traveling west on Route 28 in stop-and-go traffic. MV2 stopped and MV1 rear-ended MV2.
18	02/26/17	Sunday	6:01 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	No Injury	36	54			MV1 was attempting a left turn onto Route 28 from Santuit Newtown Road (traveling southbound). MV2 was traveling west on Route 28, and hit the back left side of MV1.
19	04/07/17	Friday	7:12 AM	Rear-end	Daylight	Clear	Dry	Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway, etc.	No Injury	38	28			MV1 was traveling west on Route 28 in heavy traffic. MV1 went around another vehicle that had begun pulling out from Santuit/Newtown Road (from the north) and hit MV2 from behind after trying to avoid the other car.
20	07/27/17	Thursday	6:26 PM	Angle	Daylight	Clear	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	No Injury	70	58			MV1 was making a left turn onto Route 28 east from Santuit-Newtown Road southbound. MV1 was waived on by a driver in opposite lane, but MV2, traveling west on Route 28, did not have time to stop and hit MV1.
21	08/17/17	Thursday	1:04 PM	Rear-end	Daylight	Clear	Dry	Followed too closely	Non-fatal injury	33	57			MV1 operator was stopped in traffic on Route 28 traveling west (at intersection with Santuit-Newtown Road). MV2 did not realize traffic was stopped and rear-ended MV1, after they were unable to stop in time.
22	09/19/17	Tuesday	9:45 AM	Rear-end	Daylight	Rain	Wet	No improper driving	No Injury	38	54			MV2 was headed north on Santuit/Newtown Road stopped at the intersection with Route 28. MV2 made a slight right and then was going to make a left to go north. MV1 made a right turn onto Route 28 east and rear-ended MV2 who they thought were intending to turn right only and continue on Route 28 (and not go north).
23	09/26/17	Tuesday	4:11 PM	Rear-end	Daylight	Clear	Dry	Distracted	Non-fatal injury	31	36			MV1 and MV2 were both traveling westbound on Route 28. MV1 stopped quickly for the car in front of it and was rear-ended by MV2.
24	11/22/17	Wednesday	4:28 PM	Angle	Dark - lighted roadway	Clear	Dry	Failure to keep in proper lane or running off road	No Injury	73	34			MV1 was traveling west on Route 28 and crossed into the eastbound lane, colliding with MV2's rear quarter panel. MV2 was attempting to travel straight from a stop on Santuit Newtown Rd.
25	11/28/17	Tuesday	5:41 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	Non-fatal injury	63	38			MV1 was attempting to turn onto Route 28 from the north on Santuit-Newtown Rd and was struck by MV1 who was travelling westbound on Route 28.

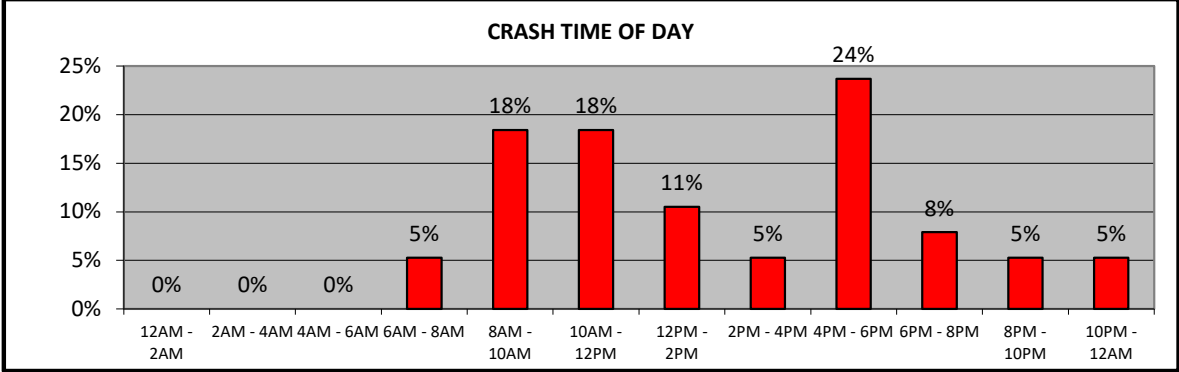
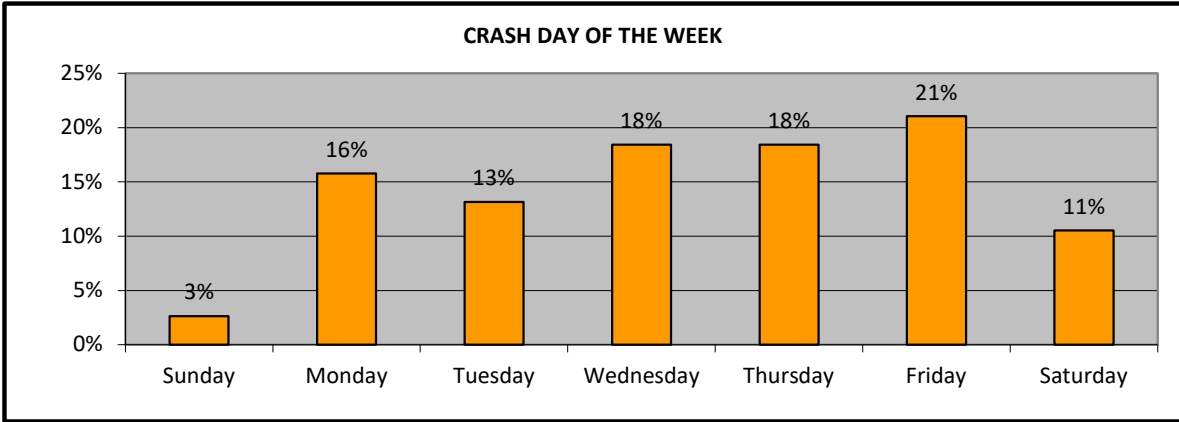
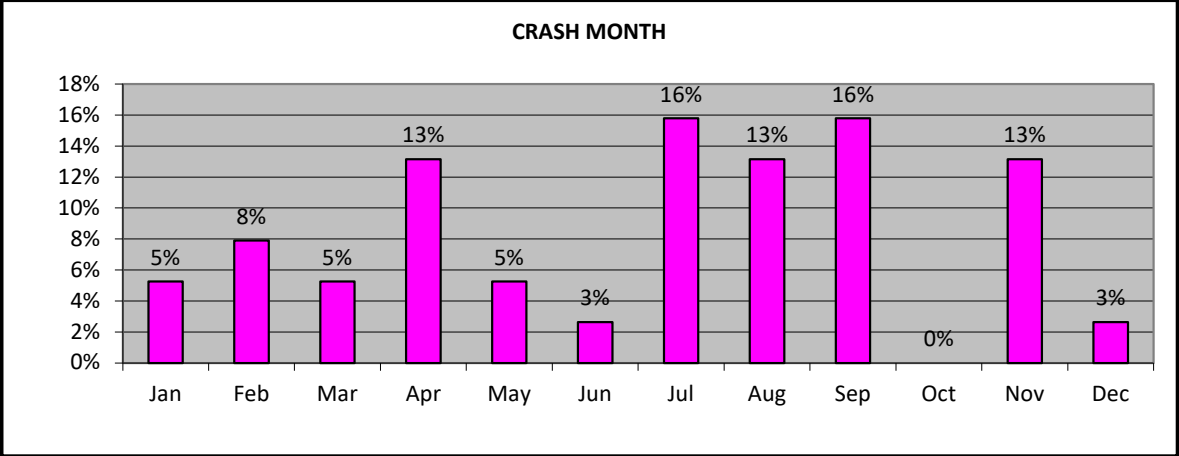
## Crash Data Summary Table

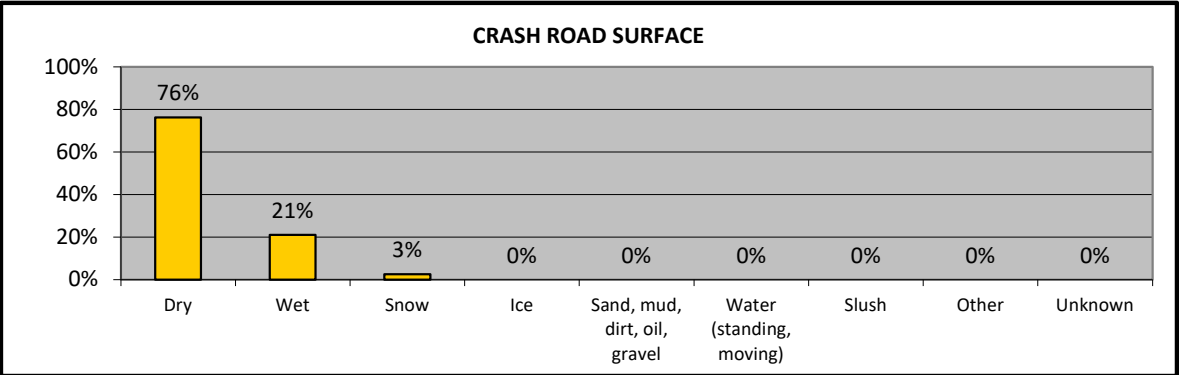
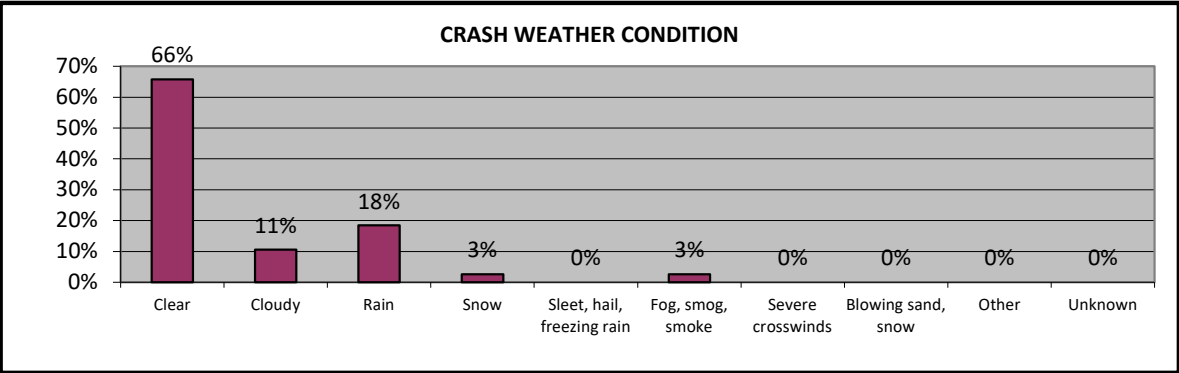
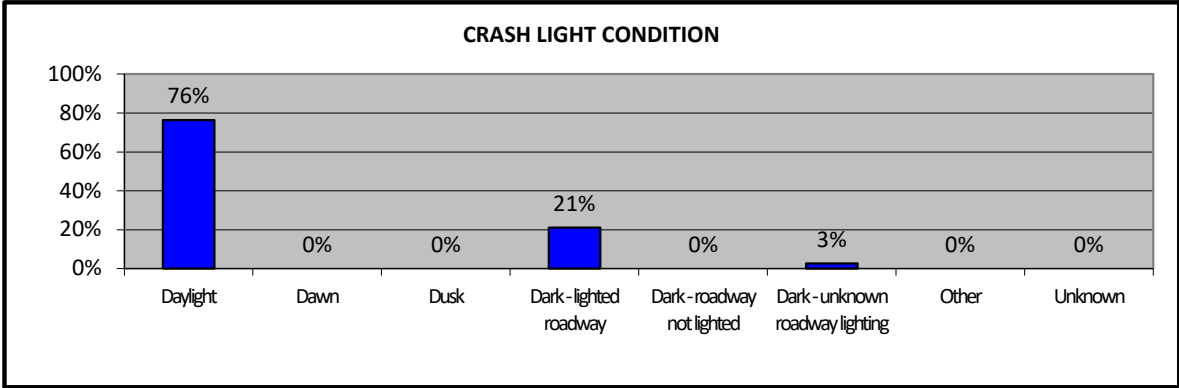
Route 28 at Santuit Newtown Road, Barnstable, MA  
2015-2019

Crash Diagram Ref #	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Injury Severity	D1 Age	D2 Age	D3 Age	D4 Age	Comments
#	mm/dd/yy	Day	hh:mm	Type	Type	Type	Type	Type	Type	#	#	#	#	
26	12/08/17	Friday	2:33 PM	Angle	Daylight	Cloudy	Dry	Unknown	No Injury	31	41			MV1 was traveling east on Route 28 and attempting a left turn onto Santuit-Newtown north. MV2 was traveling west on Route 28 and MV1 turned in front of MV1, leading to a collision.
27	01/22/18	Monday	12:03 PM	Angle	Daylight	Rain	Wet	Unknown	Non-fatal injury	52	37			MV2 was traveling east on Route 28 and was struck by MV1 who was travelling northbound and attempting to stop at the intersection but skidded on wet pavement.
28	02/10/18	Saturday	11:53 AM	Angle	Daylight	Clear	Dry	Inattention	No Injury	75	52			MV2 was traveling west on Route 28 and struck MV1 who was attempting to make a right turn from Santuit-Newton Road (from the north) onto Route 28.
29	04/19/18	Thursday	4:50 PM	Rear-end	Daylight	Rain	Wet	Followed too closely	Non-fatal injury	55	25	42		MV1 and MV2 were stopped in traffic while travelling westbound on Route 28 when they were rear-ended by MV3 who failed to stop in time.
30	05/17/18	Thursday	11:01 PM	Head on	Dark - unknown roadway lighting	Fog, smog, smoke	Dry	Failure to keep in proper lane or running off road; Over-correcting/over-steering	Non-fatal injury	40	58			MV1 was traveling west on Route 28 and swerved right,drove off the road almost hitting a sign and then swerved (overcorrecting) into the oncoming lane striking MV2.
31	07/07/18	Saturday	10:41 AM	Rear-end	Daylight	Clear	Dry	Inattention	No Injury	18	63			MV1 and MV2 were traveling north on Santuit Newtown Road stopped at the intersection. MV1 rear-ended MV2 thinking MV2 had entered the intersection.
32	08/28/18	Tuesday	2:02 PM	Rear-end	Daylight	Clear	Dry	Inattention	No Injury	28	26			MV2 rear-ended MV1 in the eastbound direction on Route 28 (west of the intersection). Both vehicles were forced to stop short due to traffic from a vehicle attempting to turn left onto Santuit-Newtown Rd.
33	09/03/18	Monday	10:50 AM	Rear-end	Daylight	Clear	Dry	Inattention	No Injury	47	46			MV1 rear-ended MV2 while travelling in stop and go traffic on Route 28 west (west of Santuit Newtown Road).
34	11/12/18	Monday	8:02 AM	Rear-end	Daylight	Clear	Dry	Inattention	No Injury	31	28			MV1 rear-ended MV2 in the westbound direction on Route 28. MV2 slowed and stopped to let a vehicle turn at the intersection and MV1 came around the bend and couldn't stop in time.
35	01/24/19	Thursday	5:32 PM	Rear-end	Dark - lighted roadway	Rain	Wet	Inattention	Non-fatal injury	20	37			MV2 and MV1 were traveling east on Route 28 in advance of Santuit-Newtown Road when MV2 slowed/stopped for traffic ahead. MV1 did not have time to stop and rear-ended MV2.
36	07/29/19	Monday	9:21 AM	Angle	Daylight	Clear	Dry	Inattention	No Injury	58	68			MV1 was travelling south on Santuit-Newtown Road, attempting to enter Route 28, and struck MV2 who was traveling west on Route 28. MV1 thought that MV2 had cleared the intersection .
37	09/04/19	Wednesday	5:18 PM	Rear-end	Daylight	Clear	Dry	Followed too closely	No Injury	56	25			MV1 rear-ended MV2 who was slowing for traffic in the westbound direction on Route 28 (west of intersection).
38	09/11/19	Wednesday	8:02 AM	Rear-end	Daylight	Clear	Dry	Followed too closely	Non-fatal injury	28	30	27		All MVs traveling west on Route 28, just west of Santuit-Newtown Road. Traffic began to slow and MV1 could not stop in time and rear-ended MV2, who then hit MV3.
39	11/01/19	Friday	11:46 AM	Angle	Daylight	Clear	Dry	Operating vehicle in erratic, reckless, careless, negligent, or aggressive manner	Non-fatal injury	51	35	45		MV3 and MV2 were both traveling east on Route 28 when MV1 traveling west on Route 28 swerved into the opposing lane, colliding with MV3 and then MV2. MV1 claimed they had to swerve out of the way of another vehicle.

**Crash Data Summary Charts**  
Route 28 at Santuit Newtown Road, Barnstable, MA







## Appendix E. Road Safety Audit References

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## Road Safety Audit References

*FHWA Office of Safety - Proven Safety Countermeasures*, U.S. Department of Transportation, Federal Highway Administration <https://safety.fhwa.dot.gov/provencountermeasures/>.

*Road Safety Audits, A Synthesis of Highway Practice*. NCHRP Synthesis 336. Transportation Research Board, National Cooperative Highway Research Program, 2004.

*Road Safety Audits*. U.S. Department of Transportation, Federal Highway Administration, <https://safety.fhwa.dot.gov/rsa/>

*FHWA Road Safety Audit Guidelines*. U.S. Department of Transportation, Federal Highway Administration, 2006.

*Road Safety Audit*, 2<sup>nd</sup> edition. Austroads, 2000.

*Road Safety Audits*. ITE Technical Council Committee 4S-7. Institute of Transportation Engineers, February 1995.